MODEL STUDIES OF APRA HARBOR, GUAM, M.I.

PROGRESS REPORT for SEPTEMBER, 1948

CALIFORNIA INSTITUTE OF TECHNOLOGY
Hydrodynamics Laboratories, Hydraulic Structures Division

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U. S. NAVY DEPARTMENT
BUREAU OF YARDS AND DOCKS

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HYDRODYNAMICS LABORATORIES
HYDRAULIC STRUCTURES DIVISION
of the
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THE COVER . . . . .

The flow pattern during drainage of the repair basin and inner harbor through the Agat Bay escape channel with a calm sea is strikingly presented in the cover photo. Each dot shows the position of a surface float at the time one of a long series of exposures was made. The closely spaced dots represent water moving at one to two knots from left to right. The areas of relatively stagnant water are represented by the short white dashes.

I. INTRODUCTION

Activities during the month were centered principally around the continuation of studies initiated in July and August and upon analysis of data collected for the studies.

Refraction diagrams are being drawn as a part of the frequency response study and will be used as an aid in the determination of the mode of oscillation of the basin.

The pollution study received the most attention during the month. A channel has been constructed in the model across Orote Peninsula between the south end of the inner harbor and Agat Bay. This channel is being used in studying the circulation possibilities in the inner harbor and repair basin under normal ocean conditions.

The wave height averaging device is now completed and calibration and testing of the circuits are progressing rapidly.

II. SCOPE OF THIS REPORT.

The report this month, as last month's, presents only a discussion of the progress made on the various studies now under consideration. No conclusions are presented because the data are only partially analyzed.

III. PROGRESS DURING THE MONTH.

A. Continuation of Frequency Response Study.

Collection and analysis of data continued this month, and wave refraction diagrams were drawn in an attempt to determine the mode of oscillation of the basin. At the present writing this problem remains unsolved; it is to be expected that the pattern of the response of the basin to ocean wave trains will be an extremely complicated one. Because of this it may not be possible to determine the mode of oscillation to any great degree of accuracy.

B. Induced Current Studies.

In order to establish currents within the harbor induced by currents in the ocean, runs have been made without waves but with ocean currents of various magnitudes. Their analysis has shown that the current imposed by the initial directional control devices used in the model was not sufficiently broad in extent to be reliable. A uniform velocity across the section desired was believed possible of attainment by a gravel resistance baffle. Test sections of gravel 4" thick and 6" thick were built in the 6 ft. wide approach channel, and measurements of their effects indicate that a section only one inch thick will be more satisfactory for obtaining a uniform distribution without excessive loss of head across the resistance.

Preliminary photographs give some idea of the circulation pattern to be expected in the harbor as a result of the imposed ocean currents. Fig. 1 shows circulation due to waves as well as to ocean currents.

C. Pollution Study.

The pollution study is now well under way and progress during the month was rapid. A channel 400 ft. wide by 32 ft. deep (prototype scale) was constructed across Orote Peninsula between the south end of the inner harbor and Agat Bay, in accordance with the proposal made on various Bureau of Yards & Docks drawings. A midget pump has been designed, built and installed at the ocean end of the channel to permit simulation of the currents to be expected in a similar channel at the prototype. Five point gages have been adapted and installed to assist in the study. The point gages will be used for measuring the draw down at specific locations as a function of the discharge through the channel. This study will permit experimental confirmation of analytical computations with regard to turnover time.

D. Model Change.

Instructions were received by dispatch of September 15, 1948 to widen the channel between the repair basin and inner harbor to 865 ft. This change has been incorporated in the model.

Fig. 1

The currents induced in the harbor by westerly waves 10 ft. high and 1200 ft. long combined with a four knot current through the escape channel from the inner harbor to Agat Bay are illustrated by the closely grouped white dots. Each sequence of dots represents the path of a reflector on the water surface over a period of approximately $2\frac{1}{2}$ hours at Guam. The spacing of the dots is indicative of the current speed, as the time between all dots is a constant (about one minute at Guam). The effect of the flow through the Agat Bay channel is particularly well represented by the paths of the reflectors through the inner breakwater opening and into the inner harbor.

The insert in the upper right-hand corner shows the midget pump installed at the southern end of the Agat Bay channel which is used to produce currents in this channel up to four knots in magnitude. The pump is sealed off from the harbor proper by a temporary dam, part of which can be seen directly above the arrow head in the upper right-hand corner.

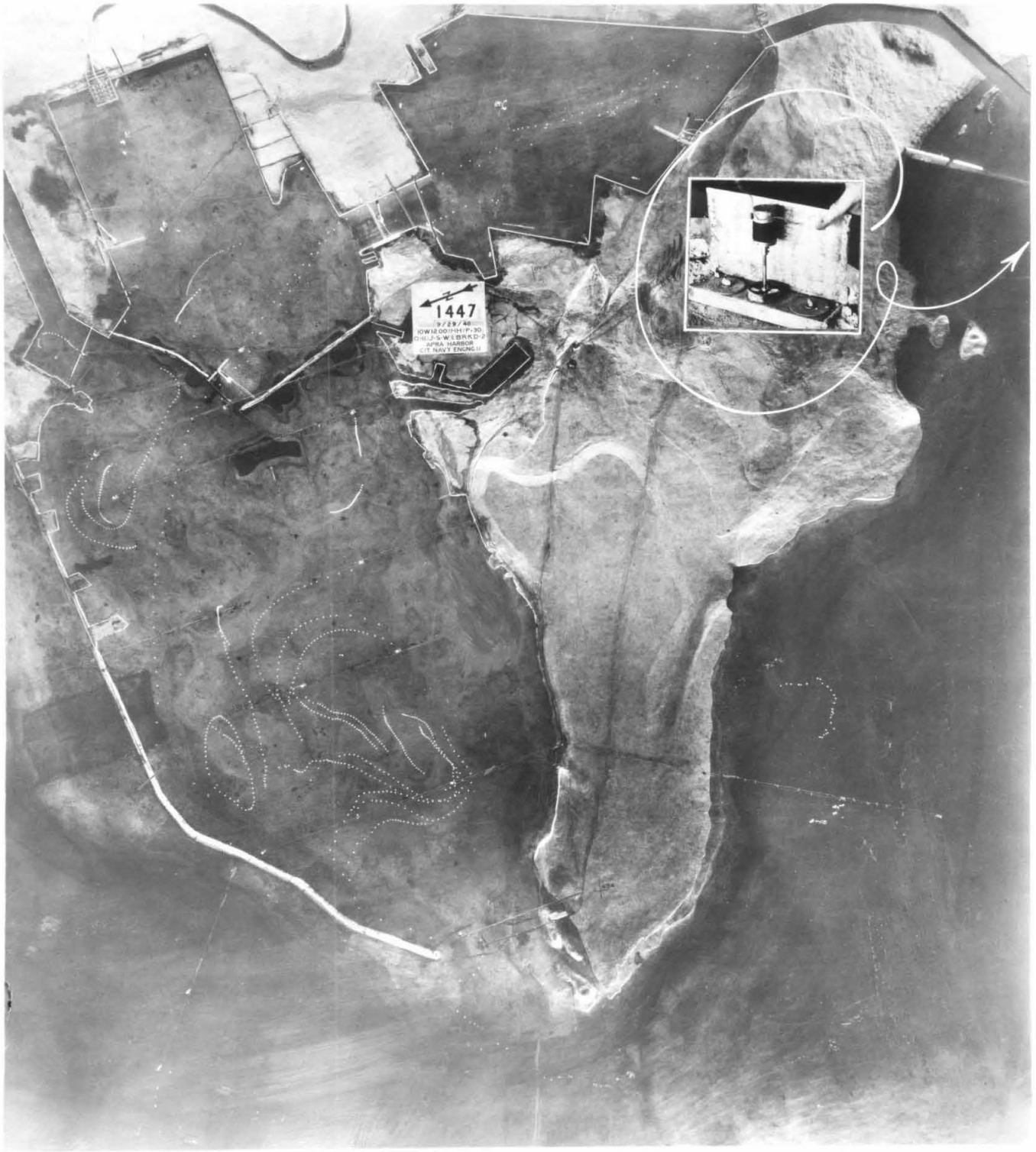

Fig. 1